

REMARKS/ARGUMENTS

Claims 19-24 were examined in the Office Action under reply, with claims 1-18 having been previously canceled. Claims 19-24 now stand rejected under 35 U.S.C. § 103 over Inomata (JP 2001-139669) in view of Langari (U.S. Patent No. 6,261,871). The present rejection is addressed in part by the present amendments and is otherwise traversed for reasons that will be discussed in detail below.

With the present amendments, claims 19, 23 and 24 have been amended and new claim 25 has been added. Thus, claims 19-25 are now pending.

Amendments and New Claims

The specification has been amended to include the patent number that corresponds to the parent application and to correct a typographical error. Substantively, the disclosure is unchanged and no new matter has been introduced.

Claim 19 has been amend to clarify the scope of the curing agent. As the Examiner pointed out in the Claim Objections, the original wording and structural formula of claim 19 restricted the claimed maleic anhydride polymers and maleic anhydride oligomers to copolymers of the particular structural formula. Claim 19 has now been amended to clarify that the curing agent is selected from maleic anhydride polymers, which by definition include copolymers, and maleic anhydride oligomers and mixtures thereof, with the proviso that if the maleic anhydride polymers are copolymers comprising norbornene, then the copolymers have the structural formula now claimed. Support for this amendment can be found, for example, in the specification at ¶¶ [009], [011], [013], and Schemes 2-6.

Claim 23 has been amended to correct a typographical error in that claim 24 was inadvertently included in claim 23. Claim 24 has also been amended to correct a typographical error in that “A” has been replaced with “The.”

New dependent claim 25 has been added to further define the curing agent. Support for this claim can be found in the specification at, for instance, paragraph 11. No new matter has been added.

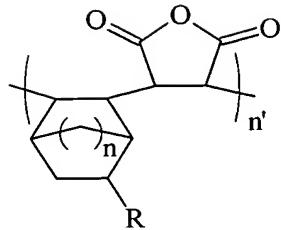
Claim Objections

Claims 19-24 were objected to because of an informality. As mentioned above, the wording and structural formula of original claim 19 overly restricts the curing agent. *See, e.g.*, ¶¶ [009], [011], and [013]. In order to clarify the scope of the curing agent of claim 19, claim 19 has been amended as outlined above. Applicants respectfully request that the objection be withdrawn.

Claim Rejections Under 35 U.S.C. §103(a)

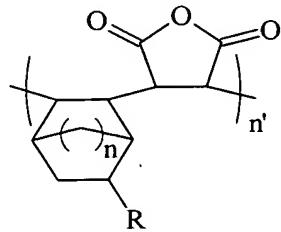
Claims 19-24 have been examined in the outstanding office action and currently stand rejected under 35 U.S.C. §103(a) as being unpatentable over Inomata (JP 2001-139669) in view of Langari (U.S. Patent No. 6,261,871). According to the Examiner, Inomata discloses a claimed resin composition and its use as an underfill composition, and Langari discloses a method of fabricating a semiconductor device by the claimed steps and using an underfill composition therein.

Claim 19 has been amended to recite that the curing agent is selected from the group consisting of low molecular weight maleic anhydride polymers, low molecular weight maleic anhydride oligomers, and a mixture thereof, wherein if the maleic anhydride polymer is a copolymer comprising norbornene, then the copolymer has the following structural formula:



where n is 1 to 3, n' is 5 to 50, and R is selected from the group consisting of ethers, lactones, anhydrides, alcohols, nitriles, epoxy, carboxylic acids, and mixtures thereof, thereby distinguishing the present invention from Inomata.

As far as the machine translation of Inomata is understood, it is respectfully submitted that Inomata does not teach a curing agent as presently claimed. The Examiner relies on the structure at paragraph [0048] of Inomata. While there is no structure at ¶ [0048], there are structures at ¶ [0043] (Formula 7), at ¶ [0046] (Formula 8), at ¶ [0049] (Formula 9), at ¶ [0052] (Formula 10), and at ¶ [0055] (Formula 11). None of Formulas 9-11 are maleic anhydride copolymers. While Formulas 7 and 8 comprise maleic anhydride, these Formulas do not fall within the curing agent of amended claim 19, wherein when the maleic anhydride polymer of claim 19 is a copolymer comprising norbornene, the copolymer has the following structural formula:



where n is 1 to 3, n' is 5 to 50, and R is selected from the group consisting of ethers, lactones, anhydrides, alcohols, nitriles, epoxy, carboxylic acids and mixtures thereof. Inomata does not disclose a similar curing agent.

Moreover, the claimed invention is distinguishable over Inomata in the function of the present curing agents. As explained in ¶ [008] of the present specification, the known anhydrides “typically only perform one function, i.e. cross-linking.” Greater cross-linking will result in a harder cured product. Inomata’s invention is entitled “Hardener, Thermosetting Resin Composition and its Cured Product.” Thus, like other known anhydrides, the anhydrides of Inomata were used to improve cross-linking, thereby resulting in a harder cured product. Inomata is unlike embodiments of the present invention in which the low molecular weight maleic anhydride polymers and oligomers are not only used to improve cross-linking, but can also be designed to modify viscosity, decrease moisture absorption, volatilization and modulus, improve mechanical properties, and/or enhance adhesion. See ¶ [009] of the present specification. None of these other functions of the curing agent were disclosed or suggested in Inomata. The different structural designs dictate different requirements for the curing agents themselves as well as the resin compositions containing the curing agents.

The presently claimed invention is also distinguishable from Inomata with respect to the molecular weight of the curing agent. While Inomata does not limit the molecular weight of its curing agents, according to paragraph [0026] of Inomata,

the handling of a curing agent may become difficult if this weight average molecular weight becomes less than 1,000, and on the other hand, when weight average molecular weight exceeds 200,000, it is because a curing agent and the compatibility between epoxy resins etc. may fall. Therefore, since balance with compatibility with the handling nature of a curing agent, an epoxy resin, etc. becomes better, it is more desirable to make weight average molecular weight of the (C) component into the value of 2,000-100,000 within the limits, and it is still more desirable to consider as the value 5,000-50,000 within the limits.

Paragraph [0026]. Applicants’ curing agents, however, comprise low molecular weight polymers and oligomers. Examples 1-6 pertain to maleic anhydride copolymers of a molecular

weight of about 1600 g/mole, which is below the “desirable” and well below the “more desirable” range disclosed by Inomata.

Moreover, applicants have found unexpected results with the present low molecular weight maleic anhydride polymers and oligomers. If the molecular weight of the curing agent is too low, e.g. a monomer, then the curing agent will volatize during processing causing porosity during curing and overall system failure. If the molecular weight of the curing agent is too high, e.g. molecular weight of 50,000, then the curing agent will gel causing miscibility and flow problems during processing. By using low molecular weight maleic anhydride polymers and oligomers, applicants have unexpectedly found that volatilization can be controlled (e.g., decreased), especially at high temperatures in, for instance, no flow underfill formulations or any sudden exposure to high temperatures in a short time, thereby reducing flow problems such as voids and die fails.

Inomata does not teach the curing agent of amended claim 19 and, as admitted by the Examiner, does not teach a method of fabricating a device as claimed. The combination of Inomata with Langari does not cure these defects. While Langari discloses a method of fabricating a semiconductor device, the Examiner did not cite Langari as disclosing the claimed curing agents and it is agreed that Langari does not disclose such. Further, the pending claims 20-25 are allowable as depending from allowable claim 19.

For all the above reasons, applicants respectfully submit that the pending claims define an invention that is novel and nonobvious over the art. A prompt indication of allowable subject matter would be much appreciated.

The Examiner is invited to contact the undersigned at (408) 975-7500 to discuss any matter concerning this application.

The Office is hereby authorized to charge any additional fees or credit any overpayments under 37 C.F.R. §1.16 or §1.17 to Deposit Account No. **11-0600**.

Respectfully submitted,

KENYON & KENYON

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By: Carrie A. Beatus
Carrie A. Beatus
(Reg. No. 47,092)

For: Shawn W. O'Dowd
(Reg. No. 34,687)
Attorneys for Intel Corporation

KENYON & KENYON
333 West San Carlos Street, Suite 600
San Jose, CA 95110
Telephone: (408) 975-7500
Facsimile: (408) 975-7501